SOLAR HEATED SWIMMING POOL

WINKLER, MANITOBA

Canada MANITOBA

PREPARED BY:

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MANITOBA/CANADA CONSERVATION AND RENEWABLE ENERGY DEMONSTRATION AGREEMENT

The availability of secure and affordable energy supplies is a subject of national concern. It is an accepted fact that our primary energy sources - oil and natural gas - are becoming less accessible and more costly. However, Canada is well-endowed with non-renewable and alternative resources that can provide a bridge into the future.

To this end, the governments of Manitoba and Canada have entered into a Conservation and Renewable Energy Demonstration Agreement which was signed May 9, 1980 and terminates March 31, 1984. The Agreement is dedicated to the development and demonstration of conservation and renewable energy technologies. Equally cost-shared by the provincial and federal governments, the program has a total budget of $18-million.

The objectives of CREDA are:

- To develop and demonstrate promising new technologies, which, when widely adopted, will exploit renewable resources, conserve energy and/or use energy more efficiently.
- To develop broad public awareness of the potential of renewable energy and conservation technology.
- To provide opportunities for the commercial application of the technologies within Manitoba.
- To create economic spin-off benefits for manufacturing, industry and commerce.
- To create employment in new or existing energy-related industries.

EXECUTIVE SUMMARY

The Town of Winkler, Manitoba, received funding under the Manitoba/Canada Conservation and Renewable Energy Demonstration Agreement (CREDA) to assist in the installation of an active solar water heater for the public swimming pool.

Solar heat gain is accomplished by pumping pool water through a 1,525 m (5,000 ft.) coil of one-inch black polyethylene plastic pipe. The heated water is then returned to the pool through the filtering system.

The design is very simple, low cost and requires minimal maintenance.

The town has experienced an approximate 40% reduction in natural gas fuel requirement for heating the pool. This savings would give a simple payback on the $2,200 (1980) cost in about two years.

This report describes the Winkler pool heating system and makes some recommendations for improvement of the operation.

RÉSUMÉ ADMINISTRATIF

La petite ville manitobaine de Winkler a reçu des fonds au titre de l'Entente Canada - Manitoba de démonstration des énergies renouvelables et des économies d'énergie (ECMDEREE) afin d'installer un chauffe-eau solaire actif à la piscine municipale.

L'eau de la piscine à énergie solaire est pompée dans des tuyaux enroulés en polyéthylène noire d'un pouce de diamètre et de 1 525 m de longueur (5 000 pieds) où elle est réchauffée pour retourner à la piscine par le système de filtrage.

Il s'agit d'un système très simple dont le coût est peu élevé et dont l'entretien est minime.

La petite ville épargne ainsi environ 40% de sa consommation en gaz naturel pour le chauffage de sa piscine. Ces économies permettraient de récuper la coût de 2 200 dollars (1980) en deux ans environ.

Dans ce rapport il y a une description du système de chauffage de la piscine de Winkler et on y fait des recommandations pour améliorer son fonctionnement.

I. INTRODUCTION

Outdoor pool water heating is one of the most appropriate applications of solar technology for the Canadian climate. The heat load occurs during the months of highest solar insolation, when the collectors can perform most efficiently.

Most active solar pool heating systems utilize some form of flat plate collector. These installations require careful design and skilled installation, in order to achieve a suitable performance that will offset their relatively high cost. Even the best system have long payback periods.

The Town of Winkler decided to use a lower technology system. Some trade-off was made in terms of reduced efficiency, however, the low capital cost and resulting quick payback on the collector are considered more than compensating.

II. LOCATION

The Town of Winkler is located at the intersection of Manitoba Highways 3 and 32, about 109 km south west of Winnipeg.

III. SYSTEM DESCRIPTION

Only minor alterations in the pool's normal filtering system were necessary to incorporate the solar heater.

The solar collector consists of 1,525 m (5,000) ft. of one-inch black polyethylene pipe coiled flat on the roof of the change area building (Figures 1, 2 and 3). The coil sits on black plastic sheeting.

Cool water is drawn from the deep end of the 794,500 litre (175,000 gallon) outdoor pool by pumps #1 and #2 (Figure 3), which feed the filter tanks. A sidestream is drawn from the suction side of these pumps by a low volume pump #3. (Figure 3 shows draw-off from the pressure side, see Recommendations Section).

The low volume pump slowly circulates the pool water through the coil, which is operated in series, and the warmed water is returned to the filter tank.

The water is pumped from the filter, through a thermostatically controlled natural gas heater, back to the pool. This completes the circulation route.

FIGURE 1 Winkler Public Swimming Pool, showing location of collector on building roof.

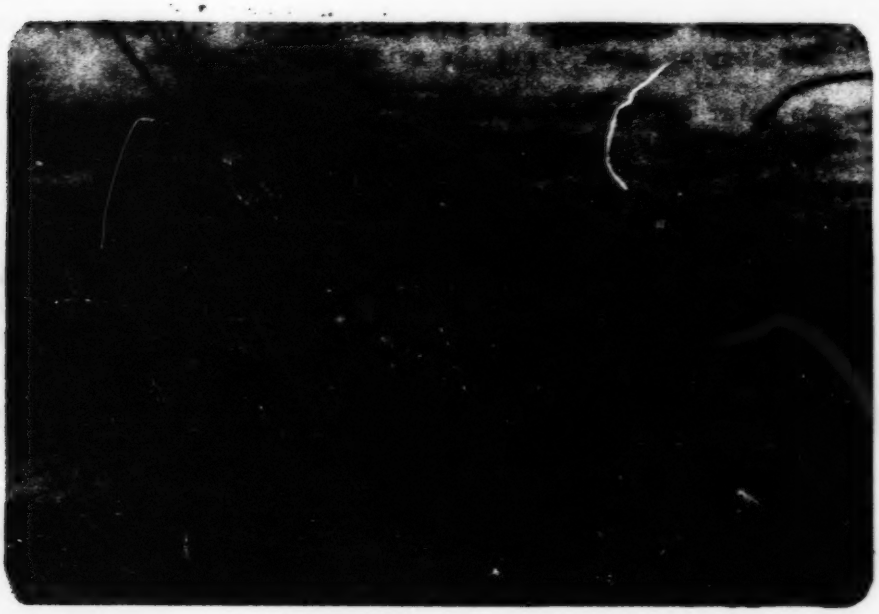
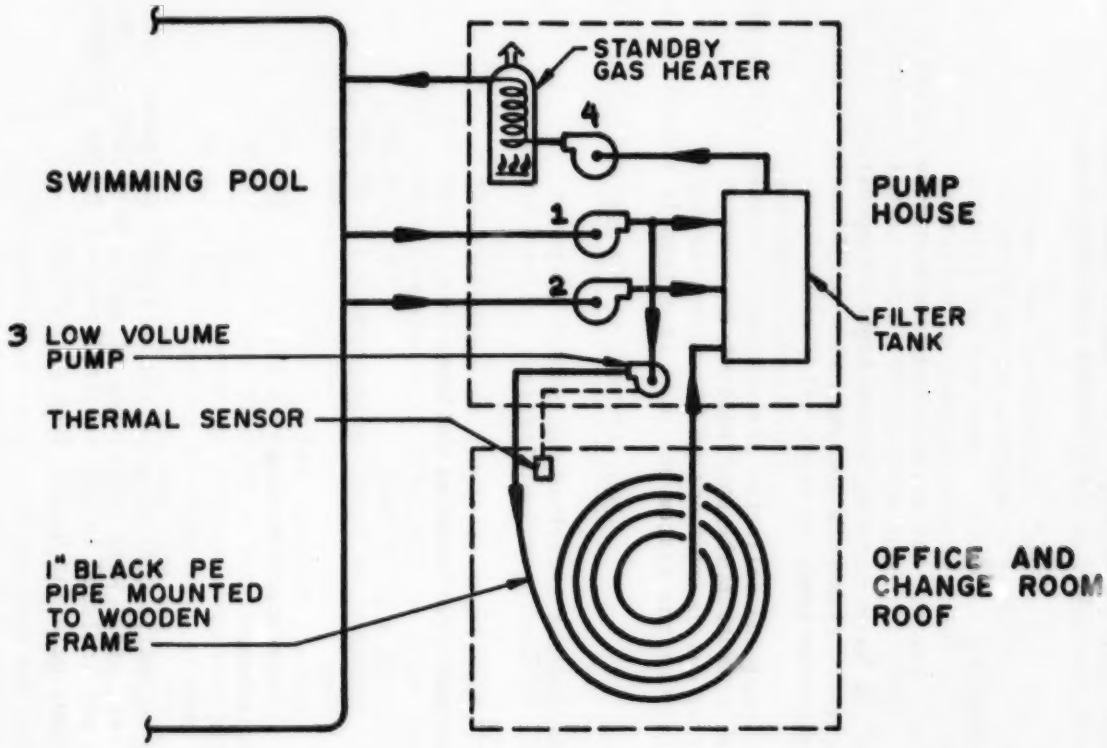


FIGURE 2 Coiled Polyethylene Pipe Collector.



WINKLER SOLAR POOL HEATING. SYSTEM

FIGURE 3

III. System Description (Continued)

As initially installed and operated the solar system was under manual control. In the second year of operation a thermostatic control was added to regulate the operation. A differential temperature control unit with roof and pool sensors automatically shuts off the low volume pump and bypasses the collector circuit when the solar gain is insufficient. Under these conditions the natural gas heater comes on to maintain pool temperature.

IV. SYSTEM PERFORMANCE

Town officials report that water temperatures can be raised from about 22°C (75°F) to about 40°C (105°F) under normal operating conditions. On warm sunny days even higher temperatures can be reached; however, these are not required and there is no means for storing excess heat.

Because the pool and collector are drained in winter, little expense is required to protect the unit against freezing.

The simplicity of the system has made it extremely economical to operate.

V. ECONOMIC ANALYSIS

5.1 Costs

The costs (1980) were as follows:

1,525 m of PE hose	$ 1,200.00
Lumber	50.00
Pump	300.00
Wiring, fittings and plastic sheeting	150.00
Labour	500.00
	$ 2,200.00

The automatic control unit and ancillary equipment (control valves, etc.) were additional at about $800 (1981). This was not included in the original project funded by CREDA, but was paid for by the Town of Winkler.

V. Economic Analysis (Continued)

5.2 Payback

Initial estimates of fuel savings varied from 30% to 50% of previous annual heating costs.

Actual fuel consumption figures for the four years prior to installation averaged 678 thousand cubic feet (mcf) of natural gas per year. For the first two years with collector operation, consumption averaged 397 mcf/year, a reduction of 281 mcf/year, or 41%.

Based on 1981 natural gas prices of $4.20/mcf, the yearly savings are $1,180, yielding a simple payback period of approximately two years on the system capital cost (without automatic controller).

Payback on the controller cost is more difficult to judge, but was estimated by the town at two to three years.

VI. CONCLUSIONS AND RECOMMENDATIONS

1. The solar system has performed satisfactorily, producing substantial savings and low payback period.

2. The technology is simple to incorporate, is low cost, and has a relatively low maintenance requirement, particularly when compared with other active solar systems.

3. Some recommendations could be made for improving the Winkler design:

   a) the 1,525 m length of black plastic pipe should be broken down into five 305 m lengths connected in parallel. This would decrease pressure drop considerably and improve heat transfer by creating a greater average thermal gradient across the pipe wall. It would also allow operation while bypassing sections for maintenance. In short, efficiency would improve.

   b) The low volume circulating pump (#3, Figure 3) should be specified to be able to draw off the pressure side of the larger pumps (as shown in Figure 3). This would ensure priming of the low volume pump and allow for smaller pump sizing.

VI. Conclusions and Recommendations (Continued)

c) It would be further advantageous to pump filtered pool water through the collector, to decrease the possible accumulation of pool debris in the coil piping.

d) The bypass to the gas heater (not shown in Figure 3) should be used to remove this unit from the flow system when it is not required.

e) The use of a pool cover in the off hours is recommended to conserve pool heat.

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